Breakdown of the scallop theorem for an asymmetrical folding molecular motor in soft matter

Titre	Breakdown of the scallop theorem for an asymmetrical folding molecular motor in soft matter
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Résumé en anglais	We use molecular dynamic simulations to investigate the motion of a folding molecular motor inside soft matter. Purcell's scallop theorem forbids the displacement of the motor due to time symmetrical hydrodynamic laws at low Reynolds numbers whatever the asymmetry of the folding and unfolding rates. However, the fluctuation theorems imply a violation of the time symmetry of the motor's trajectories due to the entropy generated by the motor, suggesting a breakdown of the scallop theorem at the nanoscale. To clarify this picture, we study the predicted violation of time reversibility of the motor's trajectories, using two reverse asymmetric folding mechanisms. We actually observe this violation of time reversibility of the motor's trajectories. We also observe the previously reported fluidization of the medium induced by the motor's folding, but find that this induced diffusion is not enough to explain the increase of the motor's displacement. As a result, the motor is not carried by the medium in our system but moves by its own, in violation of the scallop theorem. The observed violation of the scallop theorem opens a route to create very simple molecular motors moving in soft matter environments.
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